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- (71) Applicant (*for all designated States except US*):
GOLDEN WONDER LIMITED [GB/GB]; Abbey
Street, Market Harborough, Leicestershire LE16 9AA
(GB).
- (72) Inventor; and
- (75) Inventor/Applicant (*for US only*): WRATHALL, Kevin,
Roydon [GB/GB]; 10 Coach Way, Willington, Derby
DE65 6EU (GB).
- (74) Agents: POTTER, Vanessa, Juliet; Harrison Goddard
Foote, Fountain Precinct, Leopold Street, Sheffield S1 2QD
et al. (GB).
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(54) Title: APPARATUS AND METHOD FOR PRODUCING CRISP-TYPE PRODUCTS

(57) Abstract: Curved fried snack pieces made from a dough comprising: from 60 % to 95 % of a starch-based flour; from 1 % to 10 % pregelised modified starch; from 0.3 % to 2.5 % salt; from 0.3 % to 3 % shortening; from 2 % to 20 % of a non heat-treated, non-chemically modified starch-based product having a particle size in the range 250 to 710 microns, the total percentage of these ingredients being 100 % and wherein the fat content of said fried snack pieces is from 20 % to 50 %.

APPARATUS AND METHOD FOR PRODUCING CRISP-TYPE PRODUCTS

5 This invention relates to the field of an apparatus and method for the production of crisp-type products in particular products cut from an edible dough and fried to form potato crisps or chips.

10 UK patent no. GB1195137 (the Proctor & Gamble Company) describes some disadvantages associated with conventional potato crisps which are sliced from raw potatoes and fried to a crisp state in a reservoir of hot fat. The process described in GB1195137 overcomes some of these disadvantages by providing a process of preparing crisp-
15 snack food products from an edible potato-based dough and moulded individually to form a saddle-shaped snack i.e. one curved in two orthogonal planes. The snacks are retained in the moulds during frying in order to produce a very uniformly-shaped finished product.

20 However, this process has the significant disadvantage that it is costly to provide and run an individual mould for each individual crisp; the apparatus involved is mechanically complex and, since every mould passes through the hot fat in order to allow cooking of the
25 crisp held therein, the moulds themselves require regular replacement, further adding to the cost. There is also a problem in that, during production, it can be difficult to remove the cooked chips from the moulds in which they are closely held.

30 There is thus a need for apparatus and a method of producing crisp-type products having the uniformity of those described in GB1195137 but which can be produced at much lower cost and using apparatus of reduced mechanical
35 complexity.

According to a first aspect of the invention, there are provided curved fried snack pieces made from a dough comprising:

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- from 60% to 95% of a starch-based flour;
- from 1% to 10% pregelled modified starch;
- from 0.3% to 2.5% salt;
- from 0.3% to 3% shortening;
- from 2% to 20% of a non heat-treated, non-chemically modified starch-based product having a particle size in the range 250 to 710 microns,

10

the total percentage of these ingredients being 100% and wherein the fat content of said fried snack pieces is from 20% to 50%.

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This particular range of ingredients and ratios thereof provide a dough which, when fried, has a tendency to rise in the reservoir of cooking oil which enables the shape of the snack pieces to be readily formed by obstructing the upward passage of the rising snack pieces with a shaped former.

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Preferably, the fat content is from 34% to 42%.

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Preferably, said starch-based flour is selected from the group consisting of potato flakes, potato granules, corn masa, corn flour, rice flour, wheat flour and mixtures thereof.

Preferably, said pregelled modified starch is maltodextrin.

35

Preferably, said non heat-treated, non-chemically modified starch-based product is maize grits, maize polenta or a combination thereof.

5 Preferably, said shortening is an emulsifier.

Preferred embodiments of the present invention will now be more particularly described, by way of example only, with reference to the accompanying drawings in which:

10

Figure 1 is a block diagram of the apparatus of the present invention;

Figure 1A is a schematic view of eight lanes of cut ellipses and waste dough;

15 Figure 2 is an end view of the formers and fryer; and

Figure 3 is a cross-sectional schematic view of the fryer, in use.

The apparatus and process for manufacturing the curved fried snack pieces according to the invention will firstly be described in general terms with reference to Figure 1.

20 A blend of potato flours, maize flours and starches is formed as a dry powder and mixed together in mixer 10.

25 The dry powder is mixed with water to hydrate the starches and to produce a light fryable dough. The dough is taken by conveyor 11 to rollers 12 where the dough is rolled in three stages down to a thickness of approximately 0.6 - 0.7mm. A ribbed or grooved product can be obtained by using a roller at this stage having 30 suitable protrusions to impart the ribs or grooves to the dough.

35 The rolled dough then moves under a rotary cutter 13

which cuts ellipses in the dough as shown in Figure 1A. Although ellipses are preferable, other shapes can be cut, for example triangles or hexagons.

5 The ellipses 14 are aligned in "lanes", each lane being wide enough to accommodate one ellipse 14. Eight lanes 15 are shown in Figure 1A, although in practice sixteen lanes are preferable. Surrounding the cut ellipses 14, is excess dough 16 which, on separation of the ellipses 10 is returned via conveyor 17 to the mixer 10 where it is mixed with fresh dough and recycled.

The ellipses or chips 14, aligned in the lanes, are conveyed towards the fryer 20. The fryer 20 comprises a 15 reservoir of hot oil with a continuous "caterpillar track" type lower conveyor 23 located at the bottom thereof as shown in Figures 2 and 3. Located directly above the reservoir 21 and partially submerged in the oil is a continuous upper conveyor 22, which is shaped as 20 shown in cross-section in Figure 2. The part of the upper conveyor 22 which is presented to the reservoir 21, when the conveyor 22 is in motion, comprises a plurality of curved formers 24 of semi-circular cross section and which extend longitudinally along the length of the fryer 25 20. The upper conveyor 22 is constructed from a plurality of jointed sections to allow sufficient flexibility when the conveyor enters or leaves the fryer 20 (points A and B in Figure 3) whilst nesting the sections while they are in the fryer 20 to provide 30 continuous curved formers 24.

The chips 14 enter the fryer at point A, aligned in their lanes and, during frying, tend to rise upwardly where they abut curved formers 24 which prevent further upward 35 movement of the chips and which encourage the curved

shape to develop. The cooking process takes between 15 and 30 seconds at 180-185°C. Although the chips 14 are aligned precisely in lanes 15 as they enter the fryer, the chips are substantially free to rise upwardly in the fryer in order to form the curved shape.

The cooked chips leave the fryer via a transfer system 30 which comprises an oil drain conveyor where excess oil can drain from the cooked chips and a conveyor system. The chips are conveyed by the conveyor system to a flavour dispenser 40, at which powdered flavouring is applied to one side of the cooked chips.

The chips are then flipped through 180° using, for example, air jets 50 and then conveyed to be shingled and then packaged at shingling and packing stage 51. At the shingling and packing stage 51, metered lengths of shingled chips are packed into cylindrical tubes which are sealed at one end.

The cylindrical tubes of chips (still open at one end) then pass to a gas flushing system 60 in which oxygen is purged or flushed from the tubes and replaced with nitrogen, or other inert gas, in order to increase the shelf life of the finished product.

From the gas flushing system 60 the flushed tubes move to a seamer 70 where the ends of the tubes are seamed.

Finally, the sealed tubes pass through an x-ray metal detection stage 80 and from there they are palletised ready to leave the factory.

The process described in GB 1195137 utilised two-part moulds to impart the desired curved shape to the product.

The curved shape is thus formed using mechanical means.

In contrast, the process described herein aims to impart a curved shape to the product primarily by the selection of appropriate ingredients and ratios thereof to encourage the chips to rise during frying so as to abut curved formers. It can be seen from the description of the fryer 20 that, although aligned in lanes on entry into the fryer, the chips 14 are not constrained in the way those described in GB 1195137 are held in their moulds. The chips 14 naturally tend to rise when fried towards the top of the reservoir of oil, where their upward passage is obstructed by the curved formers, forcing the rising chips into the desired curved shape. Other shapes of chip could be formed by employing differently shaped formers.

The tendency of the chips to rise when fried is essential to the formation of the curved shape as, if they did not rise in the reservoir of oil, the chips would not be forced upwardly against the formers which produce their shape. The tendency of the chips to rise during cooking depends upon their recipe.

The recipe used in the process described herein is thus essential to the nature of the finished product and examples of the recipe are described below:

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35

INGREDIENTS	EXAMPLE 1 %	EXAMPLE 2 %	EXAMPLE 3 %	RANGE %	RANGE %	IDEAL RANGE %	IDEAL RANGE %
				FROM	TO	FROM	TO
Potato Flake (fully processed)	29.39	39.61	51.87	15.00	65.00	20.00	55.00
Potato Flake (low leach)	6.92	6.89	6.92	1.00	20.00	5.00	15.00
Potato Granules	50.14	39.61	27.66	15.00	65.00	35.00	55.00
Maltodextrin	3.46	3.44	3.46	1.00	10.00	2.00	6.00
Salt	0.80	0.79	0.80	0.30	2.50	0.50	1.50
Emulsifier	1.69	2.07	1.69	0.30	3.00	1.00	2.25
Maize Polenta	2.07	2.07	2.07	1.00	10.00	1.50	3.00
Maize Grits-- fine	5.53	5.51	5.53	1.00	10.00	1.50	7.00
Total Dry Mix	100.00	100.00	100.00				
Total Water	37.00	39.00	39.00	20.00	55.00	28.00	50.00

The majority ingredients (in this example two types of potato flake plus potato granules) may be replaced by other starch-based flours, for example corn or corn-masa, rice-based or wheat-based flours. The recipe contains from 60% to 95% starch-based flours in total, which may comprise more than one different source of starch-based flour, for example potato flake plus potato granules.

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In the potato example given, it is desirable to use as high a percentage as possible of potato flake which gives an improved end texture to the product. However, as the percentage of potato flake increases, the tendency of the product to expand during mixing and frying increases undesirably. This expansion causes several problems, notably difficulties in mixing the dough when the running

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mix is of suitable weight for commercial production, and the end product not being sufficiently dense to pack the required weight of product into the desired size of packaging. Uncontrolled expansion can also cause
5 undesirable blistering or bubbling of the product during frying.

Conventionally, the tendency of the product to expand could be counteracted by increasing the percentage of
10 expansion inhibitors such as emulsifier in the recipe. However, this can have a disadvantageous effect on the texture of the dough which tends to become rather crumbly and difficult to work.

15 In the present process, the tendency of the product to expand is counteracted by the use of maize grits in the recipe. The maize grits are substantially inert and hence act as a "filler" which helps to absorb oil during frying. The inertness of the maize grits also means that
20 the taste and texture of the end product is substantially unaffected by its inclusion. However the particle size of the maize grits does have a desirable effect on the physical properties of the product during frying such that the tendency of the product to expand is controlled,
25 the particles of maize grits facilitating the escape of water from the product during frying without causing bubbling or blistering. However the maize grits particles are not so large as to adversely affect the eating texture of the product.

30 Additionally, maize polenta is also included as an inert filler which helps absorb oil into the product. If the chips are thin enough, the particle size of the maize polenta will also be sufficiently large to contribute to
35 reducing the tendency of the product to expand.

By controlling the expansion of the product and by providing a product with a consistent curved shape, the end result is a product having good uniformity which can
5 stack effectively in the packaging. The product is relatively dense without loss of texture which means that a relatively high weight of product can be stacked into each tube, giving a satisfactory weight per pack. Since
10 the stack height is reduced compared to the same weight of a conventional product of this type, packaging and transport costs can be significantly reduced.

It will be appreciated that products in which the potato ingredients are replaced by other starch-based flours
15 will be different in taste and texture although the basic curved shape will be the same.

CLAIMS

1. Curved fried snack pieces made from a dough
5 comprising:

- from 60% to 95% of a starch-based flour;
- from 1% to 10% pregelled modified starch;
- from 0.3% to 2.5% salt;
- 10 • from 0.3% to 3% shortening;
- from 2% to 20% of a non heat-treated, non-chemically modified starch-based product having a particle size in the range 250 to 710 microns,

15 the total percentage of these ingredients being 100% and wherein the fat content of said fried snack pieces is from 20% to 50%.

2. Fried snack pieces as claimed in claim 1 wherein the
20 fat content is from 34% to 42%.

3. Fried snack pieces as claimed in claim 1 or claim 2 wherein said starch-based flour is selected from the group consisting of potato flakes, potato granules, corn masa, corn flour, rice flour, wheat flour and mixtures thereof.
25

4. Fried snack pieces as claimed in any of claims 1 to 3 wherein said pregelled modified starch is maltodextrin.
30

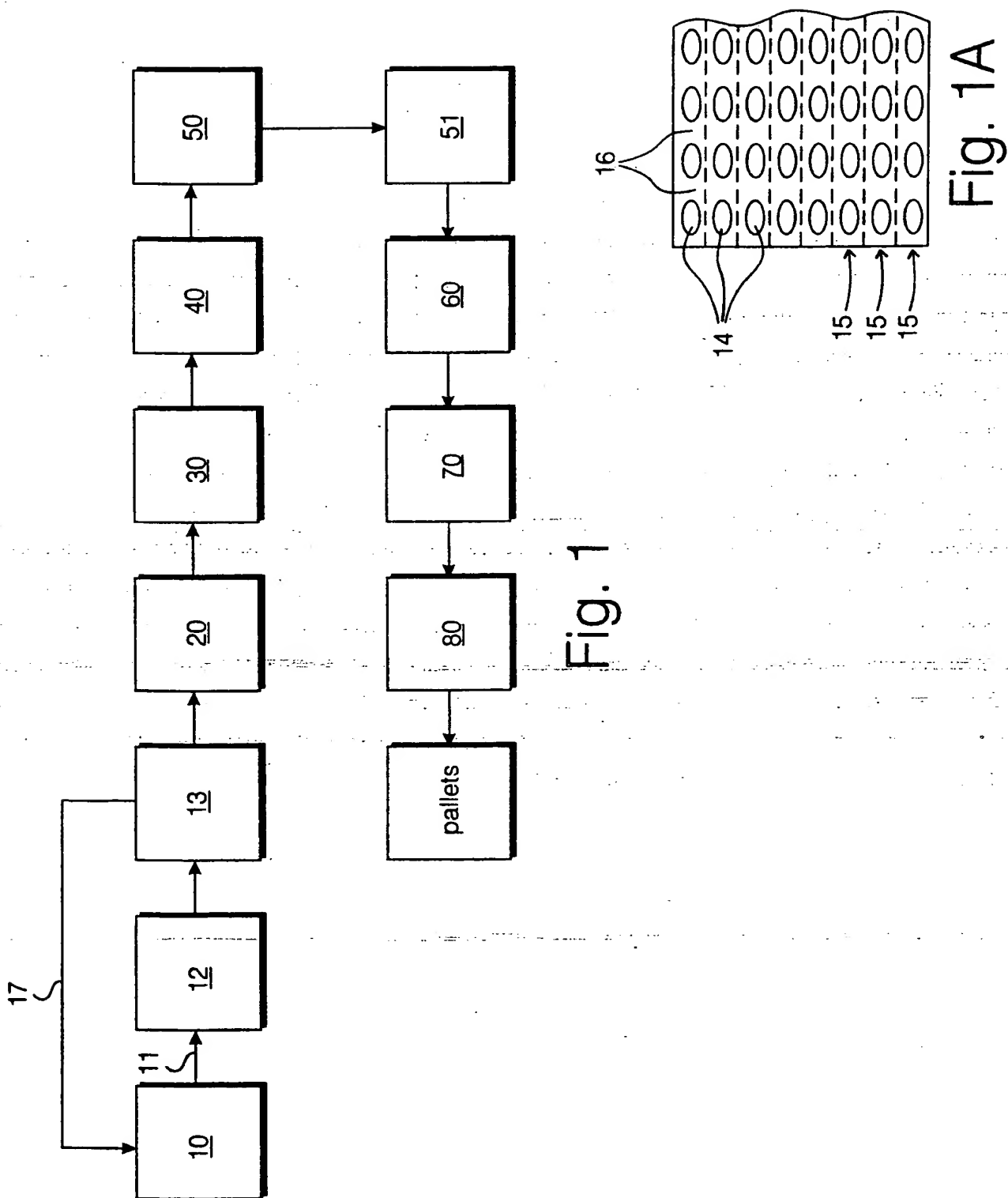
5. Fried snack pieces as claimed in any of claims 1 to 4 wherein said non heat-treated, non-chemically modified starch-based product is maize grits, maize polenta or a combination thereof.
35

6. Fried snack pieces as claimed in any of claims 1 to 5 wherein said shortening is an emulsifier.

7. Fried snack pieces substantially as described herein
5 with reference to the accompanying drawings.

8. A process for manufacturing curved fried snack pieces as claimed in any of the preceding claims.

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2/2

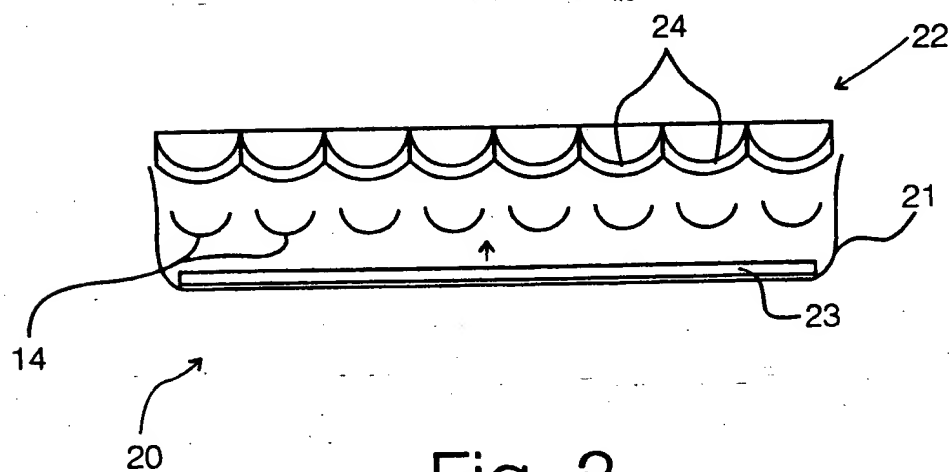


Fig. 2

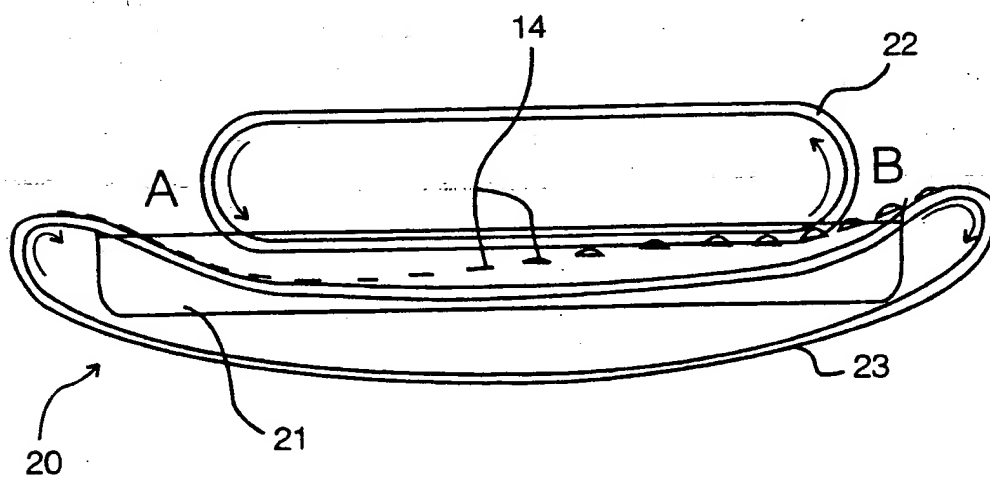


Fig. 3

INTERNATIONAL SEARCH REPORT

Int .tional Application No

PCT/GB 00/04207

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23L1/217 A23L1/164

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 132 949 A (M.N.CROWE) 12 May 1964 (1964-05-12) the whole document	1
A	EP 0 064 224 A (JAMISON WILLARD MILES) 10 November 1982 (1982-11-10) the whole document	1-8

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Vuillamy, V

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3132949	A	12-05-1964	NONE	
EP 0064224	A	10-11-1982	CA 1192076 A DE 3272834 D JP 1319069 C JP 57208952 A JP 60041571 B	20-08-1985 02-10-1986 29-05-1986 22-12-1982 18-09-1985